

Summary of the systematic review of diagnostic renal tract imaging tests for children with urinary tract infection

Aim: To evaluate the test performances of common renal tract imaging tests for the diagnosis of vesicoureteric reflux and renal damage in children following urinary tract infection (UTI). This study was done for the Commonwealth Department of Health and Aged Care and funded through the Consultative Committee of Diagnostic Imaging program. Full copies of the report are available at <http://www.kidney-research.org/>

Methods: A comprehensive search of Medline (1966 – 2000) and reference lists was undertaken to identify all published papers that compared one renal tract imaging test with another in children with proven UTI. Results are expressed as summary values for sensitivity, specificity and likelihood ratios using summary receiver operating characteristic methods.

Search Results: From 1013 articles screened, 75 publications were eligible and included. No studies assessed the ability of imaging tests to predict long-term outcomes of hypertension or kidney failure. In general studies were poorly designed and reported and did not specify important study design issues such as verification bias and blinding. Studies used kidneys and patients as their units of measure. For clarity and space reasons, results from kidneys only are presented here.

Tests for diagnosing vesicoureteric reflux using micturating cystourethrogram (MCU) as the reference standard

- Vesicouretheric reflux (VUR) is detected on MCU in 30% of children following UTI.
- Ultrasonography (15 studies, N=2495 children) has a sensitivity of 34% and specificity of 90% for the detection of children with VUR. The likelihood ratios for positive and negative tests are 3.4 and 0.73 respectively.
- ^{99m}Tc-MSA scan (13 studies, N=975 children) has a sensitivity of 51% and a specificity of 75% for the detection of children with VUR. The likelihood ratios of positive and negative test are 2.55 and 0.65 respectively.

This means that in 100 children with UTI, with an expected prevalence of VUR of 30 %, (ie 30 cases of VUR, 70 children without VUR) we would expect the following detected and missed cases of reflux using ultrasound (USS) and DMSA.

Test	<i>Detected cases</i> (children with VUR)	<i>Missed cases</i> (children with VUR missed)	False positive results (mislabelled VUR when reflux is not present)
Ultrasound	10/30	20/30	7/70
^{99m} Tc-DMSA scan	15/30	15/30	18/70

Tests for diagnosing renal damage using ^{99m}Tc-DMSA scans as the reference standard

- 18 studies of ^{99m}Tc-DMSA scans examined renal damage and 18 looked at both renal damage and VUR.
- ^{99m}Tc-DMSA scans identify renal damage in 10% of children 1 year after a UTI, 40% of children at the time of the UTI, and 60% of children who have been hospitalised with a febrile UTI.

- Ultrasonography (13 studies, N=3195 children) has a sensitivity of 67% and a specificity of 93% for renal damage. The likelihood ratios for positive and negative tests are 9.57 and 0.35 respectively.
- MCU (13 studies, N= 975 children) has a sensitivity of 56% and a specificity of 73% for renal damage. The likelihood ratios for positive and negative tests are 2.07 and 0.60 respectively.

For 100 children investigated following UTI we could expect prevalences of renal damage on ^{99m}Tc-DMSA scan of 10% (1 year after UTI), 40% (at the time of UTI irrespective of the presence of fever), and 60% (children hospitalised with UTI). For 100 children with a UTI;

Test	Number of cases with renal damage	Detected cases by USS or MCU	Missed cases	False positive results
MCU	10 (1yr after UTI)	6/10	4/10	24/90
	40 (at time of UTI)	22/40	18/40	16/60
	60 (hospitalised)	34/60	26/60	11/40
Ultrasound	10 (1yr after UTI)	7/10	3/10	6/90
	40 (at time of UTI)	27/40	13/40	4/60
	60 (hospitalised)	40/60	20/60	3/40

Comment: Both renal ultrasound and micturating cystourethrograms are imprecise predictors of renal damage.

Similarly renal ultrasounds and ^{99m}Tc-DMSA scans are poor predictors of VUR. No single imaging modality can predict both renal damage and VUR.

